tional departments of museums, to consider the same idea, at least in the labeling of certain exhibits for specific classes of society and for certain purposes?

I do not recall ever having seen an exhibit labeled in such a manner as to indicate that a study had been made of "the art of questioning, by which the children" and the public "are directed, inspired and attain the desired mental growth. Telling the wrong thing and at the wrong time deadens interest and stunts the child's powers. Whenever practicable, the material should be observed first in its natural environment." In such a museum department the labels might describe that environment, giving the locality, etc., but leave the visitor to make some discoveries. By a process of this kind he would be forcibly impressed.

I would not by any means suggest that specimens in museums are over-labeled or that the best forms of existing labels should be set aside, but rather that if a few interrogatory labels and exhibits were tried as an experiment in a case or two, it might open up a new line of possibilities to workers in certain departments of museums and in some kinds of museums.

The quotations above are from a syllabus on nature study for the primary grades for normal college students by William Hittell Sherzer, Ph.D.

Harlan I. Smith
American Museum of Natural History,
December 7, 1906

SPECIAL ARTICLES

NOTE ON THE COMPOSITION OF LIMULUS BLOOD ASH

Within recent years much attention has been given by physiologists and pharmacologists to the chemical condition of automatic tissues. It is generally conceded that a complete knowledge of the chemical reactions going on in the tissues would go far towards clearing up the mechanism of automatism. The rôle played by the inorganic constituents of the plasma has received particular attention. The principal organs used in the study of automatism have been the heart and ciliated epithelium. Little work has been done toward finding out to what extent the automatism of the ganglion cells depends on the chemical changes going on in cells or in the surrounding fluids during the activity of the cells. The respiratory center in vertebrates is not readily isolated for such study. Neither can most of the work done on the vertebrate heart be applied to the ganglion cells themselves, because in most of these experiments the results are complicated by the simultaneous action of the chemicals on the heart muscle.[1]

This may account in part for the existence of the two theories of the origin of the heart beat. It may be that a more exact knowledge of the chemical changes taking place in the heart muscle, the ganglion cells and their surrounding fluids, will explain the reason for the existence of these divergent views. The importance of data on the chemical reactions taking place in the ganglion cells, especially during activity, is obvious. Such data would lead either to important generalizations or to the refutation of generalizations already made.

On account of its unique anatomy, the Limulus heart offers the best organ known for the study of ganglion automatism. The heart may continue to beat rhythmically for days after its removal from the body. The optimum temperature for keeping up this activity is from 15° to 20° C. (Carlson). The ganglion is easily dissected from the heart without injuring its connections with the heart muscle through its numerous nerves. The heart thus serves as a delicate indicator for the activity of the ganglion.

Carlson[2] has made use of this preparation in the study of ganglion automatism. The chemical phase of this investigation requires a knowledge of the composition of the Limulus blood plasma, particularly the inorganic constituents. A qualitative and quantitative analysis of the plasma during both rest and activity, may give a better understanding of the mechanism of automatism. If we find that there are certain changes in the composition of the plasma during activity of the ganglion or heart muscle, we may conclude that

[1] Carlson. Personal communication.

[2] Carlson, A. J., *Am. Journal Physiol.*, 1906, XVI., p. 221; XVI., p. 378.

these changes are causally related to such activity. The change in potential produced by a slight chemical change in a complex solution like the plasma may be of greater significance than a corresponding change in the potential of a simple solution of its inorganic constituents. For even a slight change in the plasma during activity may be sufficient to modify or to neutralize the electrical potential between the proteid complex in the cell and the solution in which it is held. This might result in the precipitation of the proteid complex, or sufficient change to act as a stimulus.

At the request of Dr. Carlson, who has been working on this problem, I made an approximate analysis of the Limulus blood, not knowing of the analyses already made by Genth and by Gotch and Laws.[3] The results of the three analyses agree so closely that all of them are given. No attempt has been made by me to find how the acids and bases are combined except the usual routine methods given by Hoppe-Seyler and the methods adopted by the A. O. A. C.; both of these methods were used wherever they differed.

BLOOD ASH OF LIMULUS.

	Genth.		Gotch and Laws.
NaCl	83.50 %	79.207	85.184
KCl	2.395	4.667	2.707
K_2SO_4	1.686	3.264	.594
$CaSO_4$	3.470	2.159	3.986
$CaCO_3$	1.448	2.950	.275
MgO	5.128	1.959	6.457
$MgCl_2$	1.840	3.848	—
$Mg_2P_2O_7$	.444	1.709	0.236
Fe_2O_3	.081	traces	.029
CuO	.085	0.297	0.508
P_2O_5	—	—	—
SO_3	—	—	—
Cl	—	—	—
SiO_2	—	—	—

BLOOD OF LIMULUS (MCGUIGAN).
Summary of results.

	Per Cent.	
Water		91.784
Solids:		
Proteid	5.162	
Ash	2.676	
Other organic constituents	.378	
		8.216

[3] Von Furth, 'Vergleichende Chemische Physiologie der niederen Tiere,' 1903, p. 88.

Ash.

Cl (total)	54.820
NaCl	28.600
KCl	2.930
CaO	2.510
MgO	5.580
P_2O_5	0.340
Fe_2O_3 (not determined)	trace
CuO	0.273
SO_3	1.570
SiO_2	.420
Cl (uncombined with K and Na)	3.281
CO_2	not determined

Although the results agree fairly well, yet there are differences. Whether or not these differences are sufficient to cause an appreciable change in the metabolism of the ganglion cells as evidenced by the behavior of the heart muscle remains to be investigated. Any change in the metabolism of the ganglion cells would be more stimulating if the changes in the composition of the plasma were sufficiently rapid to prevent the acclimatization of the colloids. However, as the sea water itself varies in composition in different localities, in order to get a close agreement in the blood ash, it may be necessary to select animals from the same locality. The ash which I examined was prepared at the Marine Biological Laboratory, Woods Hole, Mass. The proteid and moisture content were determined immediately after the removal of the Limulus from the water. Before any definite conclusions can be drawn from this work it may be necessary to make more analyses.

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QUOTATIONS

THE GREAT MEN OF FRANCE

THE word *plébiscite* has been for more than thirty years a word of ill-omen in France. One of the most widely circulated of French newspapers, the *Petit Parisien,* has, however, been rehabilitating the word during the last few weeks in a way too striking to be ignored. It appealed to its readers all over the country to vote on the question of the relative preeminence of great Frenchmen of the last century. Fifteen million answers have been re-